

Chapter 18: MP&M Benefit / Cost Comparison

INTRODUCTION

The preceding Chapters 12 through 16 provided quantitative and qualitative assessments of the expected benefits to society from reduced MP&M effluent discharges under the final regulation. Chapter 11 assessed the regulation's expected social costs. This chapter sums the estimated values for the benefit categories that EPA was able to monetize, and compares the aggregate benefits estimate with the estimate of social costs.

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18.1 ESTIMATING NATIONAL LEVEL BENEFITS AND COSTS

EPA traditionally estimates national level costs and benefits by extrapolating analytic results from sample facilities to the national level using sample facility weights. EPA's traditional sampling approach relies on information about the economic and technical characteristics of the regulated community. Although important for understanding the technical requirements and costs of a regulation, this sampling approach does not incorporate information that could significantly affect the occurrence and distribution of regulatory benefits, such as characteristics of the receiving water body and the size of population that may benefit from reduced pollutant discharges. As a result, the traditional sampling approach may yield benefit estimates that are less accurate than those that could be obtained by using a sampling framework that accounts for such benefit-receptor characteristics.

EPA recognizes that using a traditional extrapolation method to estimate national-level benefits may lead to a large degree of uncertainty in benefits estimates. Therefore, in addition to the traditional extrapolation method used in the proposed rule, EPA also estimated national-level benefits for the final rule using an alternative extrapolation method.¹

Under this method, EPA used an alternative set of sampling weights, based on a post-sampling stratification method, to calculate alternative national estimates of benefits. EPA adjusted the original sample weights using two variables that are likely to affect the occurrence and size of benefits associated with reduced discharges from sample MP&M facilities: receiving water body type and size, and the size of the population residing in the vicinity of the sample facility. The Agency used a commonly used post-stratification method calling "raking" to adjust original sample weights to reflect these benefit pathway characteristics. EPA used data from three data sources – EPA's Permit Compliance System database (PCS), EPA's Reach File 1, and Census Data – to develop the adjusted weights. Because of data limitations, EPA restricted the re-weighting effort only to direct dischargers and excluded indirect dischargers that are not considered in the final MP&M rule. EPA therefore performed this alternative analysis for only the selected option. Appendix G details the post-sampling stratification method used to adjust the original sample weights.

EPA uses the post-stratification extrapolation benefit estimates to validate general conclusions that the Agency draws from its main analysis based on the traditional extrapolation method.

¹ EPA also conducted a sensitivity analysis of national benefits for the final MP&M regulation by extrapolating the results of the Ohio case study to the national level. The results of this analysis are presented in Appendix G.

18.2 SOCIAL COSTS

As discussed in Chapter 11, EPA estimated the cost to society from compliance with the final regulation. The components of social costs include the resource cost of compliance (e.g., labor, equipment, material, and other economic resources needed to comply with the rule), costs to governments administering the regulation, and the social costs of unemployment resulting from facility closures. EPA estimated that the final rule will cause no unemployment and thus impose no unemployment-related costs to society. EPA also estimated that governments will incur no additional costs from administering the regulation. EPA estimated the final rule's annual cost to society at \$13.82 million (2001\$). This value is based only on the estimated resource cost of compliance.

18.3 BENEFITS

EPA developed a partial monetary estimate of the final rule's expected benefits based on three benefit categories: human health, water-based recreation (including nonuse value), and economic productivity benefits (avoided sewage sludge disposal costs). The Agency estimated the total monetized benefits by summing the monetary values reported in the preceding chapters across all categories of benefits. As noted in Chapter 12, these benefits estimates are incomplete because they omit numerous mechanisms by which society is likely to benefit from reduced effluent discharges from the MP&M industry. Examples of benefit categories not reflected in these monetized estimates include:

- ▶ non-lead and non-cancer related health benefits,
- ▶ improved aesthetic quality of waters near discharge outfalls,
- ▶ benefits from improved wildlife habitat, including habitat for threatened or endangered species,
- ▶ tourism benefits, and
- ▶ reduced costs of drinking water treatment.

The Agency estimated the total national benefits based on three extrapolation approaches. Table 18.1 summarizes the monetary value of benefits to society from the final rule. Traditional extrapolation yields total benefit values of \$0.88 to \$2.36 million (2001\$) annually, with a midpoint estimate of \$1.45 million (2001\$). Benefits estimates based on the post-stratification extrapolation method range from \$0.57 to \$1.54 million (2001\$), with a midpoint estimate of \$0.98 million.

The ranges of national benefit estimates from the two extrapolation methods substantially overlap, with each method confirming the value estimated by the other method. This finding provides confidence in the reasonableness of the estimates from the separate extrapolation methods, given the limitations of data and coverage of benefit categories underlying the analysis for both methods.

18.4 COMPARING MONETIZED BENEFITS AND COSTS

EPA cannot perform a complete cost-benefit comparison because not all of the benefits resulting from the final regulatory option can be valued in dollar terms. As reported in Table 18.1, combining the national estimates of benefits and costs yields the following value of net monetizable benefits under the traditional and post-stratification extrapolation methods:

- ▶ Under the traditional extrapolation technique, the estimated net monetizable benefits range from negative \$11.5 million to negative \$12.9 million annually (2001\$). Comparing the midpoint estimate of social costs with the midpoint estimate of monetized benefits results in a net benefit of negative \$12.3 million (2001\$).
- ▶ The post-stratification extrapolation method, which does not affect the estimated costs of the rule, results in total net monetizable benefits ranging from negative \$12.3 to negative \$13.3 million (2001\$), with a midpoint estimate of negative \$12.8 million (2001\$).

The lack of a comprehensive benefits valuation limits the assessment of the relationship between costs and benefits of the final rule. EPA believes that the benefits of regulation, even in the low-estimate case (post-stratification extrapolation), would be comparable to the social costs if all of the benefits of regulation could be quantified and monetized.

Table 18.1: Comparison of National Annual Monetizable Benefits to Social Costs: Final Rule (2001\$)

Benefit and Cost Categories	Low	Mid	High
<i>Final Option -- Traditional Extrapolation</i>			
Benefit Categories			
Reduced cancer risk from fish consumption	\$90	\$90	\$90
Reduced cancer risk from water consumption	\$0	\$0	\$0
Reduced risk from exposure to lead	\$0	\$0	\$0
Enhanced water-based recreation	\$586,503	\$999,838	\$1,574,380
Nonuse benefits	\$293,252	\$499,919	\$787,190
Avoided sewage sludge disposal costs	N/A	N/A	N/A
Total Monetized Benefits^a	\$879,845	\$1,499,846	\$2,361,660
Cost Categories			
Resource costs of compliance	\$13,824,563	\$13,824,563	\$13,824,563
Costs of administering the final regulation	\$0	\$0	\$0
Social costs of unemployment	\$0	\$0	\$0
Total Monetized Costs	\$13,824,563	\$13,824,563	\$13,824,563
Net Monetized Benefits (Benefits Minus Costs)^b	(\$12,944,718)	(\$12,324,717)	(\$11,462,903)
<i>Final Option -- Post-Stratification Extrapolation</i>			
Benefit Categories			
Reduced cancer risk from fish consumption	\$134	\$134	\$134
Reduced cancer risk from water consumption	\$0	\$0	\$0
Reduced risk from exposure to lead	\$0	\$0	\$0
Enhanced water-based recreation	\$382,105	\$651,392	\$1,025,705
Nonuse benefits	\$191,053	\$325,696	\$512,852
Avoided sewage sludge disposal costs	N/A	N/A	N/A
Total Monetized Benefits^a	\$573,292	\$977,221	\$1,538,691
Cost Categories			
Resource costs of compliance	\$13,824,563	\$13,824,563	\$13,824,563
Costs of administering the final regulation	\$0	\$0	\$0
Social costs of unemployment	\$0	\$0	\$0
Total Monetized Costs	\$13,824,563	\$13,824,563	\$13,824,563
Net Monetized Benefits (Benefits Minus Costs)^b	(\$13,251,271)	(\$12,847,342)	(\$12,285,872)

^a EPA did not estimate low and high benefits estimates for reduced cancer risk or lead exposure because it used a single estimate for the value of a statistical life (VSL) to estimate mortality benefits in these categories. EPA calculated low and high estimates of total monetized benefits by adding midpoint benefits estimates for cancer risk and lead exposure to respective low and high estimates of recreation and nonuse benefits.

^b EPA's estimate of social cost is based only on the estimated resource cost of compliance and was calculated as only a single value instead of a range. Low, mid, and high net benefit values were calculated by subtracting the total monetized cost estimate from low, mid, and high estimates of total monetized benefits.

Source: U.S. EPA analysis.

Chapter 19: Social Costs and Benefits of Regulatory Alternatives

INTRODUCTION

EPA considered three regulatory options as alternatives to the selected MP&M rule. These options (the Proposed/NODA Option, Directs + 413 to 433 Upgrade Option, Directs + All to 433 Upgrade Option) are described in Chapter 4. EPA estimated the social costs and benefits of these three options, using the same methods applied in the analyses of the final rule. This chapter summarizes the results of these benefit and cost analyses. The total number of facilities reported for the Proposed/NODA Option (Option II) analysis differs from the facility count reported for the final rule and Options III and IV. After deciding in July 2002 not to consider the NODA option as the basis for the final rule, EPA performed no more analysis on the NODA option, including not updating facility counts and related analyses for the change in subcategory and discharge status classifications.

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19.1 ESTIMATED SOCIAL COSTS

EPA estimated social costs for the final rule and alternative options in *Chapter 11: Social Costs*. This section provides a summary of those results.

19.1.1 Compliance Costs for MP&M Facilities

Table 19.1 presents the estimated resource value of compliance costs by discharge status under the final option and alternative regulatory options. These compliance costs are not adjusted for the effect of taxes or pass-through of compliance costs to customers, and therefore represent the social value of resources used for compliance. EPA annualized compliance costs using a 7 percent discount rate over a 15-year analysis period. A more detailed description as well as the results presented by subcategory can be found in *Chapter 11: Social Costs*. The total resource compliance costs of the final rule are equal to \$13.8 million (2001\$). The total annualized compliance costs under the Proposed/NODA Option are \$1,620.3 million, or 117 times the final rule's compliance costs. The total annualized compliance costs under the Directs + 413 to 433 Upgrade Option are \$96.8 million, or 7 times the final rule's costs. The total annualized compliance costs under the Directs + All to 433 Upgrade Option are \$138.2 million, or 10 times the final rule's costs.

Table 19.1: Resource Value of Compliance Costs under Different Options (millions, 2001\$)			
Option	Indirect	Direct	Total
Option I: Selected Option (Directs Only)	\$0.0	\$13.8	\$13.8
Option II: Proposed/NODA Option	\$1,111.4	\$508.9	\$1,620.3
Option III: Directs + 413 to 433 Upgrade Option	\$83.0	\$13.8	\$96.8
Option IV: Directs + All to 433 Upgrade Option	\$124.4	\$13.8	\$138.2

Source: U.S. EPA analysis.

19.1.2 Government Administrative Costs

The final rule excludes all indirect dischargers from coverage. EPA therefore expects no POTW administrative costs for the final rule. Under the alternative options, which include indirect dischargers, EPA expects no increase in permitting costs for facilities that already hold a permit in the baseline. However, governments will incur additional permitting costs for unpermitted facilities (under the Proposed/NODA option only) and to accelerate repermitting for some indirect dischargers that currently hold permits. The alternative regulatory options may also cause some administrative costs to decrease. For example, control authorities will no longer have to repermit facilities that are estimated to close as a result of the MP&M rule.

EPA estimates that each of the three alternative options considered would result in *reduced* POTW regulatory costs. These cost savings result from regulatory closures (i.e., facilities that currently hold a permit and would have required repermitting in the baseline, but that will no longer require repermitting under the regulatory options). The cost savings as a result of regulatory closures outweigh the additional costs of issuing new permits (under the Proposed/NODA option only) and repermitting on an accelerated, three-year schedule.

Table 19.2 below presents the estimated permitting costs to governments of administering the final rule and alternative options. *Chapter 7: Government and Community Impact Analysis* describes the methodology used to estimate these administrative costs. Estimated annualized cost savings to POTWs for the three alternative regulatory options range between \$0.05 and \$1.0 million under the Proposed/NODA option, and between \$0.03 and \$0.2 million under the Directs + 413 to 433 Upgrade Option and the Directs + All to 433 Upgrade Option (all costs in (2001\$)).

Table 19.2: Annualized Government Administrative Costs by Regulatory Option (2001\$)			
Option	Low	Medium	High
I: Selected Option	n/a	n/a	n/a
II: Proposed/NODA Option	(46,000)	(198,000)	(1,027,000)
III: Directs + 413 to 433 Upgrade	(26,000)	(56,000)	(218,000)
IV: Directs + 433 to All Upgrade	(26,000)	(55,000)	(213,000)

Source: U.S. EPA analysis.

19.1.3 Cost of Unemployment

The loss of jobs associated with any facility closures would represent a social cost of the regulation. However, from its facility impact analysis, EPA estimates that no facilities will close as a result of the final rule. Accordingly, EPA estimates a zero cost of unemployment for the final regulation.

Table 19.3 presents the estimated social costs of unemployment for the alternative regulatory options, for which EPA estimated closures. These estimates include the estimated willingness-to-pay to avoid cases of involuntary unemployment, and the cost of administering the unemployment compensation system for unemployed workers. EPA annualized costs using a 7 percent discount rate over a 15-year analysis period.

The Agency based lower-bound estimates of the number of net job losses expected from compliance. Net job losses are estimated at 26,060 jobs under the Proposed/NODA Option, 7,319 under the 413 Upgrade Option, and 7,011 under the Local Limits Option. The gross estimate for lost employment, which does not consider increased employment from compliance activities and thus provides a conservative upper-bound of potential unemployment effects, is 32,729 jobs under the Proposed/NODA Option and 7,874 under both 433 Upgrade Options. From these estimates for lost employment, social costs of unemployment under the Proposed/NODA Option range from \$344 million to \$454 million (2001\$). Social costs of unemployment under the 433 Upgrade Options range from \$83 million to \$109 million (2001\$).

Table 19.3: Social Costs of Unemployment for Final Rule and Alternative Options
(millions, 2001\$)

Unemployment/ Cost Category	Option I: Selected Option (Directs Only)	Option II: Proposed/NODA Option			Option III: Directs + 413 to 433 Upgrade Option			Option IV: Directs + All to 433 Upgrade Option		
		Low	Mid	High	Low	Mid	High	Low	Mid	High
Net Unemployment (FTE-years) ^a	n/a	26,060			7,319			7,011		
Gross Unemployment (FTE-years) ^a	n/a	32,729			7,874			7,874		
Annualized Cost of Unemployment	n/a	\$344.16	\$399.22	\$454.29	\$82.80	\$96.05	\$109.30	\$82.80	\$96.05	\$109.30
Annualized Administrative Cost	n/a	\$0.44	\$0.44	\$0.44	\$0.11	\$0.11	\$0.11	\$0.11	\$0.11	\$0.11
Total Social Cost of Unemployment	n/a	\$344.60	\$399.66	\$454.73	\$82.91	\$96.16	\$109.40	\$82.91	\$96.16	\$109.40

^a Number of FTE positions multiplied by the duration of employment/unemployment. EPA assumed that workers losing jobs due to regulatory closures would be unemployed for one year. The timing and duration of employment gains due to compliance expenditures differ for employment associated with manufacturing and installing equipment (in the first year) and operating and maintaining equipment (all 15 years of the analysis period).

Source: U.S. EPA analysis.

19.1.4 Total Social Costs

EPA estimated that the final rule will not result in social costs of unemployment and that governments will not incur additional costs in administering the regulation. EPA estimates the total social cost of the final rule at \$13.8 million (2001\$). This cost results entirely from the estimated resource costs of compliance.

For the Proposed/NODA Option, EPA estimated social costs to range from \$1.96 billion to \$2.07 billion (2001\$) annually based on the cost estimates presented above. The midpoint estimate, \$2.02 billion is almost 150 times greater than the final rule's social cost. This increase results from the more stringent technology requirements for most subcategories under the Proposed/NODA Option compared to those under the final rule. In addition, this alternative option includes additional subcategories not covered by the regulation.

For the Directs + 413 to 433 Upgrade Option, EPA estimated social costs to range from \$180 million to \$206 million (2001\$) annually. The midpoint estimate, \$193 million, is 14 times greater than the final rule's social cost. This increase results from requiring facilities currently regulated under the Electroplating regulations (40 CFR 413) to comply with the Metal Finishing regulations (40 CFR 433).

For the Directs + All to 433 Upgrade Option, EPA estimated social costs to range from \$221 million to \$247 million (2001\$) annually. The midpoint estimate, \$234 million, is 17 times greater than the final rule's social cost. This increase results from requiring facilities currently regulated by local limits or general pretreatment standards to meet with the Metal Finishing regulations (40 CFR 433).

19.2 ESTIMATED BENEFITS

EPA estimated the benefits for the alternative options based on the methodologies described in Chapters 12 through 16.

19.2.1 Human Health Benefits

EPA used the methodology described in Chapter 13 to assess human health benefits from reduced incidence of cancer from consumption of contaminated fish tissue and drinking water under the three alternative options.

EPA estimated that the final rule, as well as both upgrade options, would reduce incidence of cancer from consumption of contaminated fish by $1.4\text{E-}5$ cancer cases per year. The Proposed/NODA Option would eliminate an estimated 0.57 cancer cases per year from the baseline level. The estimated monetary value of reduced incidence of cancer from consumption of contaminated fish is \$3.68 million under the Proposed/NODA Option, \$90 (2001\$) under the final rule and Directs + 413 to 433 Upgrade Option, and \$169 (2001\$) under the Directs + All to 433 Upgrade Option.

Under the final rule, as well as both upgrade options, EPA expects no reductions in cancer cases from consumption of contaminated drinking water. Under the Proposed/NODA Option, 0.001 fewer cancer cases are expected annually from the baseline level. Estimated annual monetary benefits resulting from fewer cancer cases caused by the consumption of contaminated drinking water are \$6,536 (2001\$) for the Proposed/NODA Option.

EPA used the methodology described in Chapter 14 to assess benefits to children and adults from reduced exposure to lead under the alternative options. EPA estimated that the final rule will yield no lead-related benefits to children from reduced consumption of contaminated fish. Annual lead-related benefits for children of \$20.8 million (2001\$) are expected for the Proposed/NODA Option. The Directs + 413 to 433 Upgrade Option and the Directs + All to 433 Upgrade Option would result in \$1.3 and \$1.5 million (2001\$) in lead-related benefits for children, respectively.

EPA estimated that the Proposed/NODA Option would reduce neonatal mortality by 1.60 cases, and avoid an estimated loss of 1,078 IQ points. The Directs + 413 to 433 Upgrade Option and the Directs + All to 433 Upgrade Option would reduce cases of neonatal mortality by 0.15 and 0.17, and avoid the loss of 32 and 36 IQ points, respectively. EPA estimated lead-related benefits for adults at \$7.0 million under the Proposed/NODA Option, and approximately \$0.7 million (2001\$) for both upgrade options. Combined lead-related benefits for children and adults total \$27.8 million for the Proposed/NODA Option, and between \$2.0 and \$2.2 million (2001\$) for both upgrade options. Table 19.4 summarizes all health-related benefits.

Table 19.4: Annual Human Health Benefits for the Alternative Options (2001\$)

Regulatory Option	Reduced Cancer Risk from Fish Consumption		Reduced Cancer Risk from Water Consumption		Lead-Related Benefits		Total Monetized Human Health Benefits
	Number of Cancer Cases	Monetary Value	Number of Cancer Cases	Monetary Value	Children	Adult	
Proposed/NODA Option							
Baseline	0.920		3.117				
Proposed/NODA Option	0.353	\$3,684,973	3.116	\$6,536	\$20,791,073	\$7,048,025	\$31,530,607
Final Option Alternatives							
Baseline	0.033		5.3E-07				
Selected Option	0.033	\$90	5.3E-07	\$0	\$0	\$0	\$90
Directs + 413 to 433 Upgrade	0.033	\$90	5.3E-07	\$0	\$1,303,590	\$704,574	\$2,008,254
Directs + 413 + 50% LL Upgrade	0.033	\$169	5.3E-07	\$0	\$1,457,640	\$785,304	\$2,243,113

Source: U.S. EPA analysis.

19.2.2 Recreational Benefits

EPA used the methodology described in Chapter 15 to assess improvements in recreational benefits under the alternative options. The Agency found that the final option will reduce the occurrence of pollutant concentrations in excess of **ambient water quality criteria (AWQC)** limits by 2 percent (9 of 395 baseline occurrences) (see Table 19.5). EPA found that the Proposed/NODA Option would reduce pollutant concentrations in excess of AWQC limits by 2.6 percent (154 of 5,999 baseline occurrences), while both upgrade options would reduce such occurrences by 72 percent (285 of 395 baseline occurrences) from the baseline level.

EPA estimated the range of recreational value increases (including both use and nonuse value) for these reaches resulting from habitat improvements for each option. EPA expects recreational value of improved reaches to increase by \$0.9 million to \$2.4 million annually under the final rule, \$406 million to \$956 million annually under the Proposed/NODA Option, \$182.7 million to \$443.5 million under the Directs + 413 to 433 Upgrade Option, and by \$183.5 million to \$445.9 million under the Directs + All to 433 Upgrade Option (2001\$) (see Table 19.7). The midpoint estimates of combined annual recreational and nonuse benefits under these options are \$1.5 million, \$649 million, \$297.0 million, and \$298.5 million (2001\$). The midpoint estimates of recreational and nonuse benefits are approximately 200 times greater under the upgrade options than under the final rule.

Table 19.5: Number of MP&M Discharge Reaches with MP&M Pollutant Concentrations Exceeding AWQC Limits

Regulatory Status	Number of Reaches with Concentrations Exceeding			Number of Reaches with Concentrations Exceeding AWQC Limits ^a
	AWQC Acute Exposure Limits for Aquatic Species	AWQC Chronic Exposure Limits for Aquatic Species	AWQC Limits for Human Health	
Proposed/NODA Option				
Baseline	330	928	5,865	5,999
Proposed/NODA Option	86	539	5,803	5,845
Final Option Alternatives				
Baseline	18	353	78	395
Selected Option	9	344	78	386
Directs + 413 to 433 Upgrade	0	53	78	109
Directs + 413 + 50% LL Upgrade	0	31	78	109

^a All reaches exceeding aquatic acute exposure limits also exceed chronic exposure limits. In order not to double count the number of reaches expected to benefit from the regulation, the total number of reaches exceeding AWQC limits is the sum of the number of reaches that exceed human health criteria and the number exceeding aquatic chronic criteria, which do not also exceed AWQC limits for human health.

Source: U.S. EPA analysis.

19.2.3 Avoided Sewage Sludge Disposal or Use Costs

The final rule will not regulate indirect dischargers and therefore will not reduce metals discharges to POTWs or the number of POTWs that exceed land application standards for sewage sludge disposal. However, reduced metals discharges to POTWs resulting from the Proposed/NODA Option would enable 48 additional POTWs to dispose of sewage sludge by land application, resulting in \$22.8 million (2001\$) in cost savings (see Table 19.6). The Directs + 413 to 433 Upgrade Option and the Directs + All to 433 Upgrade Option would not reduce the number of POTWs that exceed land application standards. However, under both upgrade options 15 POTWs would be able to improve their sludge quality from meeting the land application low standard to meeting the land application high standard, resulting in approximately \$16,929 (2001\$) in cost savings to POTWs.

Table 19.6: Cost Savings from Land Application

Regulatory Option	# of POTWs Exceeding Land Application (High) Standards	Cost Savings from Upgrading Sewage Sludge Disposal Methods (2001\$)
Proposed/NODA Option		
Baseline	5,328	
Proposed/NODA Option	5,259	\$22,825,584
Final Option Alternatives		
Baseline	856	
Selected Option	856	\$0
Directs + 413 to 433 Upgrade	856	\$16,929
Directs + All to 433	856	\$16,929

Source: U.S. EPA analysis.

19.2.4 Total Monetized Benefits

EPA estimates total monetized benefits under the final option ranging from \$879,845 to \$2,361,660 (2001\$), with a midpoint estimate of \$1,499,846. Total monetized benefits for the Proposed/NODA Option range from \$460 million to \$1,010 million, with a midpoint estimate of \$704 million (2001\$). Total monetized benefits estimates for the Directs + 413 to 433 Upgrade Option and the Directs + All to 433 Upgrade Option are similar, with respective ranges of \$185 million to \$446 million, and \$186 million to \$448 million (2001\$). Midpoint estimates of total monetized benefits for these options are \$299 million and \$301 million (2001\$), respectively. Midpoint estimates for monetized benefits for the upgrade options are approximately 200 percent higher than the midpoint estimate of benefits for the final rule.

19.3 COMPARISON OF ESTIMATED BENEFITS AND COSTS

Combining the estimates of social benefits and social costs under the final option yields net monetized benefits ranging from negative \$11.5 million to negative \$12.9 million (2001\$), with a midpoint estimate of negative \$12.3 million (see Table 19.7).

Under the Proposed/NODA Option, net monetized benefits range from negative \$1,505 million to negative \$1,064 million (2001\$) per year, with a midpoint estimate of negative \$1,316 million. Annual net monetized benefits under the Directs + 413 to 433 Upgrade Option and the Directs + All to 433 Upgrade Option range from \$5 million to \$240 million, and negative \$35 million to positive \$201 million (2001\$) per year, respectively. Midpoint estimates of net benefits for these options are \$106 million and \$66 million (2001\$), respectively (see Table 19.7). As discussed in Chapter 12, the benefits assessment of regulatory options is necessarily incomplete due to the omission of numerous mechanisms by which society is likely to benefit from reduced effluent discharges.

Table 19.7: Comparison of Social Benefits and Costs of Alternative Options (2001\$)

Benefit and Cost Categories^d	Low	Mid	High
<i>Selected Option</i>			
Benefit Categories			
Reduced Cancer Risk from Fish Consumption	\$90	\$90	\$90
Reduced Cancer Risk from Water Consumption	\$0	\$0	\$0
Reduced Risk from Lead Exposure	\$0	\$0	\$0
Enhanced Water-Based Recreation	\$586,503	\$999,838	\$1,574,380
Nonuse Benefits	\$293,252	\$499,919	\$787,190
Avoided Sewage Sludge Disposal Costs	N/A	N/A	N/A
Total Monetized Benefits^a	\$879,845	\$1,499,846	\$2,361,660
Cost Categories			
Resource Costs of Compliance	\$13,824,563	\$13,824,563	\$13,824,563
Administration Costs to POTWs	\$0	\$0	\$0
Social Costs of Unemployment	\$0	\$0	\$0
Total Monetized Costs	\$13,824,563	\$13,824,563	\$13,824,563
Net Monetized Benefits (Benefits Minus Costs)^b	(\$12,944,718)	(\$12,324,717)	(\$11,462,903)
<i>Proposed/NODA Option</i>			
Benefit Categories			
Reduced Cancer Risk from Fish Consumption	\$3,684,973	\$3,684,973	\$3,684,973
Reduced Cancer Risk from Water Consumption	\$6,536	\$6,536	\$6,536
Reduced Risk from Lead Exposure	\$27,839,098	\$27,839,098	\$27,839,098
Enhanced Water-Based Recreation	\$270,366,433	\$432,938,869	\$637,360,014
Nonuse Benefits	\$135,183,216	\$216,469,435	\$318,680,007
Avoided Sewage Sludge Disposal Costs	\$22,795,620	\$22,825,584	\$22,855,548
Total Monetized Benefits^a	\$459,875,876	\$703,764,495	\$1,010,426,176
Cost Categories			
Resource Costs of Compliance	\$1,620,252,136	\$1,620,252,136	\$1,620,252,136
Administration Costs to POTWs	(\$46,000)	(\$198,000)	(\$1,027,000)
Social Costs of Unemployment	\$344,597,370	\$399,662,865	\$454,728,360
Total Monetized Costs	\$1,964,803,507	\$2,019,717,002	\$2,073,953,497
Net Monetized Benefits (Benefits Minus Costs)^c	(\$1,504,927,631)	(\$1,315,952,507)	(\$1,063,527,321)

Table 19.7: Comparison of Social Benefits and Costs of Alternative Options (2001\$)			
Benefit and Cost Categories^d	Low	Mid	High
<i>Directs + 413 to 433 Upgrade</i>			
Benefit Categories			
Reduced Cancer Risk from Fish Consumption	\$90	\$90	\$90
Reduced Cancer Risk from Water Consumption	\$0	\$0	\$0
Reduced Risk from Lead Exposure	\$2,008,254	\$2,008,254	\$2,008,254
Enhanced Water-Based Recreation	\$121,808,075	\$197,990,383	\$295,661,071
Nonuse Benefits	\$60,904,038	\$98,995,192	\$147,830,535
Avoided Sewage Sludge Disposal Costs	\$11,319	\$16,929	\$22,539
Total Monetized Benefits^a	\$184,731,776	\$299,010,848	\$445,522,489
Cost Categories			
Resource Costs of Compliance	\$96,779,134	\$96,779,134	\$96,779,134
Administration Costs to POTWs	(\$26,000)	(\$56,000)	(\$218,000)
Social Costs of Unemployment	\$82,907,075	\$96,155,345	\$109,403,616
Total Monetized Costs	\$179,660,209	\$192,878,479	\$205,964,750
Net Monetized Benefits (Benefits Minus Costs)^c	\$5,071,567	\$106,132,369	\$239,557,739
<i>Directs + All to 433 Upgrade</i>			
Benefit Categories			
Reduced Cancer Risk from Fish Consumption	\$169	\$169	\$169
Reduced Cancer Risk from Water Consumption	\$0	\$0	\$0
Reduced Risk from Lead Exposure	\$2,243,113	\$2,243,113	\$2,243,113
Enhanced Water-Based Recreation	\$122,360,444	\$198,976,248	\$297,272,287
Nonuse Benefits	\$61,180,222	\$99,488,124	\$148,636,143
Avoided Sewage Sludge Disposal Costs	\$11,319	\$16,929	\$22,539
Total Monetized Benefits^a	\$185,795,267	\$300,724,583	\$448,174,251
Cost Categories			
Resource Costs of Compliance	\$138,237,664	\$138,237,664	\$138,237,664
Administration Costs to POTWs	(\$26,000)	(\$55,000)	(\$213,000)
Social Costs of Unemployment	\$82,907,075	\$96,155,345	\$109,403,616
Total Monetized Costs	\$221,118,739	\$234,338,009	\$247,428,280
Net Monetized Benefits (Benefits Minus Costs)^c	(\$35,323,472)	\$66,386,574	\$200,745,971

^a EPA did not estimate low and high benefits estimates for reduced cancer risk or lead exposure because a single estimate for the value of a statistical life (VSL) was used to estimate mortality benefits in these categories. EPA calculated low and high estimates of total monetized benefits by adding midpoint benefits estimates for cancer risk and lead exposure to respective low and high estimates of recreation and nonuse benefits.

^b EPA's estimate of social costs for the final regulation is based only on the estimated resource costs of compliance and is a single value instead of a range. EPA calculated low, mid, and high net benefit values by subtracting the total monetized cost estimate from low, mid, and high estimates of total monetized benefits.

^c EPA calculated the low net benefit value by subtracting the high value of costs from the low value of benefits, and calculated the high net benefit value by subtracting the low value of costs from the high value of benefits. The mid net benefit value is the mean value of benefits less the midpoint of costs.

^d Category values may not sum to reported totals due to rounding of individual estimates for presentation purposes.

Source: U.S. EPA analysis.

GLOSSARY

ambient water quality criteria (AWQC): published and periodically updated by the EPA under the Clean Water Act. The criteria reflect the latest scientific knowledge on the effects of specific pollutants on public health and welfare, aquatic life, and recreation. The criteria do not reflect consideration of economic impacts or the technological feasibility of reducing chemical concentrations in ambient water. The criteria serve as guides to states, territories, and authorized tribes in developing water quality standards and ultimately provide a basis for controlling discharges or releases of pollutants into our nation's waterways. AWQC are developed for two exposure pathways: ingestion of the pollutant via contaminated aquatic organisms only, and ingestion of the pollutant via both water and contaminated aquatic organisms.

ACRONYM

AWQC: ambient water quality criteria

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